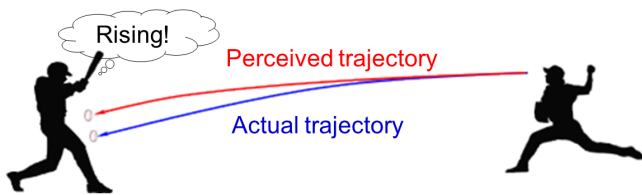


Abstract

Baseball batters sometimes feel that the pitched fastball rises as it approaches the home plate. While some physical parameters of the pitched ball, such as ball spin rate and axis orientation, can generate the rising perception, **we propose that the pitching motion-related information can also cause the "rising" ball effect**, since the batters are known to watch pitching motion to predict pitched ball behavior. We used a head-mounted display to evaluate the rising perception of fastballs in elite baseball players. **A virtual reality (VR) system was developed that manipulated pitching motion duration with fixed ball behavior.** Altering the pitching motion duration changed the rising perception, suggesting that **the batters predict ball behavior based on the pitching motion dynamics and the prediction generate the "rising" illusion for fastballs.** Our VR system will be useful not only in correcting athletic perception but also enhanced cognitive training in many sports.

Pitched ball perception

Characteristics of pitched ball depend on more than the ball's physical parameters such as ball speed and trajectory.



Subjective attributes such as the rising perception also important, the perceptual mechanisms remain unclear.

Evaluating the rising perception by VR

Using a virtual reality (VR) system, we manipulated some pitching parameters such as pitching motion duration and ball speed with fixed ball trajectory, and then evaluated the rising perception.

The pitcher (red dots) and ball motions were presented

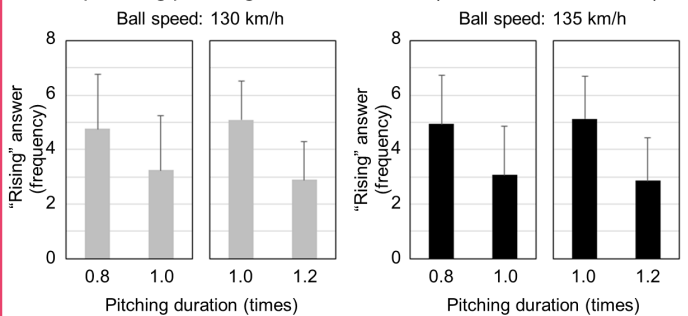
Head-mounted display (Oculus Quest 2)

29 semi-professional baseball players participated

\* This research is in collaboration with Keio University.

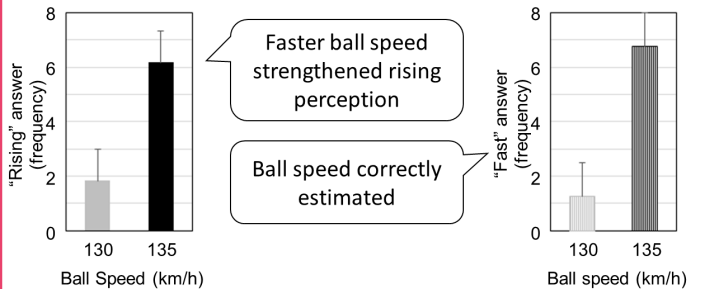
Manipulating pitching motion duration changes the rising perception

Manipulating pitching motion duration (0.8, 1.0 or 1.2 times)



Regardless of ball's physical attributes such as ball speed, shorter pitching motion strengthened rising perception

Pitching duration: 1.0 times



Faster ball speed strengthened rising perception

Ball speed correctly estimated

- ◆ The rising fastball perception was generated not only by ball's physical behavior but also by pitching motion information.
- ◆ The rising perception includes a perceptual illusion driven by pitching motion-based prediction.
- ◆ Visual manipulation with VR will be useful not only in correcting athletic perception but also enhanced cognitive training.

References

[1] T. Fukuda, A. Endo, M. Sugimoto, T. Kimura, "How do elite baseball batters perceive a "rising" fast ball?," in *Proc. North American Society for the Psychology of Sport and Physical Activity 2022 Annual Conference*, 2022.

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